

WHAT IS CLAIMED IS:

1. A method of producing a glass substrate for a mask blank, in which a surface of the glass substrate is polished by the use of a polishing liquid containing abrasive grains, wherein:

the abrasive grains comprise colloidal silica abrasive grains produced by hydrolysis of an organosilicon compound.

2. A method of producing a glass substrate for a mask blank, in which a surface of the glass substrate is polished by the use of a polishing liquid containing colloidal silica abrasive grains, wherein:

the polishing liquid containing the colloidal silica abrasive grains is neutral.

3. A method according to claims 1 or 2, wherein:
a content of alkali metal in the colloidal silica abrasive grains is 0.1 ppm or less.

4. A method of producing a glass substrate for a mask blank, comprising a polishing process of polishing a surface of the glass substrate by the use of a polishing liquid containing colloidal silica abrasive grains, by moving a polishing member and the glass substrate relative to each other while the polishing member is pressed against the surface of the glass substrate under a predetermined pressure, wherein:

the polishing process comprising a surface roughness control step of polishing the surface of the glass substrate under a polishing pressure to finish the surface of the glass substrate to a predetermined surface roughness and a protrusion suppressing step, following the surface roughness control step, of applying a suppressing pressure lower than the polishing pressure to suppress occurrence of fine convex protrusions.

5. A method according to claim 4, wherein:
the pressure applied to the substrate in the protrusion suppressing step is 100 g/cm² or less.
6. A method of producing a glass substrate for a mask blank, comprising a step of cleaning a surface of the glass substrate by a cleaning liquid after the surface of the glass substrate is precision-polished by the use of a polishing liquid containing colloidal silica abrasive grains, wherein:
the cleaning liquid has an etching action to the glass substrate and a stronger etching action to impurities, such as metal particles, contained in the polishing liquid and adhered to the glass substrate.
7. A method according to claim 6, wherein:
the cleaning step is carried out by the use of the cleaning liquid containing hydrofluoric acid (HF) and/or fluorosilicic acid (H₂SiF₆).
8. A method according to any one of claims 1, 2, 4 and 6, wherein:
the glass substrate is one of a glass substrate for a phase shift mask blank to be exposed by an ArF excimer laser, a glass substrate for a phase shift mask blank to be exposed by an F₂ excimer laser, and a glass substrate for a EUV reflective mask blank.
9. A method of producing a mask blank, wherein:
a thin film for causing an optical change in exposure light is formed on a principal surface of the glass substrate produced by the method according to any one of claims 1, 2, 4 and 6.
10. A method of producing a transfer mask, wherein:
the thin film of the mask blank produced by the method according to claim 9 is patterned to form a thin film pattern on the glass substrate.
11. A method of producing a semiconductor device, wherein:
a fine pattern is formed on a semiconductor substrate by lithography using the transfer mask produced by the method according to claim 10.

12. A glass substrate for a mask blank, wherein:
 - the glass substrate has a principal surface,
 - the principal surface contains Si and O as main components, and
 - the principle surface does not include fine convex surface defects having a height between about 2 nm and about 7 nm.
13. A mask blank, comprising:
 - the glass substrate according to claim 12, and
 - a thin film formed on the principal surface of the glass substrate to cause an optical change in exposure light.
14. A transfer mask formed by the use of the mask blank according to claim 13 and having a thin film pattern formed on the glass substrate by patterning the thin film.